probably its author himself could have wished. A wrong impression of the subject is created by the title, which though singularly happy in itself does not fairly describe the contents of the book. Such a title suggests an accurate and luminous discussion of the phenomena of evaporation and condensation, the growth and movements and disappearances of mists and clouds, the formation and distribution of rain and the laws regulating the rainfall over the globe, the meaning of frost, the birth and history of hail and snow, the circulation of water over the land with the ways and workings of brook, stream, and river, from mountain-peak to sea-shore, the architecture and the functions of snow-fields, glaciers, and icebergs—in short a kind of scientific poem, dedicated to the glory of that grand old element—water. Dr. Tyndall could write such a poem better than most men, and indeed it was with the expectation that he had attempted it that we opened this last volume of his. Out of the 192 pages 28 are devoted to clouds, rains, rivers, waves of light and heat, oceanic distillation and mountain condensers. The rest treat wholly of ice. So that if we may judge by the relative space devoted to the different forms of water, ice must be six times more important than all the rest put together. A less ambitious title, such as its author could readily suggest, descriptive of the fact that the book is a record of work, intellectual and corporeal, among the Swiss glaciers, would prevent the feeling of disappointment with which many a reader has no doubt come to the last page.

Dr. Tyndall did not intend, we suppose, that his book should be regarded in any other light than as a popular exposition of his subject, and would probably disclaim any place for it as a contribution of new facts and reasonings to our knowledge of glaciers. His narratives of last year's climbings and observations read very much like those of older ones with which he has already made us familiar. They are pleasantly written, and will convey to a reader, who has never seen a glacier, a picturesque notion of what he has missed. But surely it was not necessary to rake up again the Forbes-Rendu controversy, nor to renew the claims of Agassiz and Guyot. We could have wished, too, that while alluding to Mr. Mathews and other recent observers on ice-structure the writer had taken some notice of the attack upon his own theory by Canon Mosely and Mr. Croll.

OUR BOOK SHELF

Die Anwendung Des Spectralapparate von Dr. K. Vierordt. (Tübingen: H. Laupp, 1873.)

Dr. Vierordt has been endeavouring to found a quantitative spectrum analysis for bodies giving an absorption spectrum. His method consists in the use of a slit divided horizontally into two parts; one of these is adjusted to a certain width; the solution whose absorption is to be examined is placed opposite this, and in front of the other half is placed another solution of the same body but of a different strength, and the slit is then narrowed or widened as the solution is stronger or weaker until the absorption is the same in both halves of the spectrum. The width of the latter slit is then read off. By using a number of solutions of strengths varying decimally from the weakest possible to the strongest through which light will pass, curves are obtained and a solution of unknown strength can then be interpolated in the curve and its value ascertained. The solutions to be examined are, of of course, kept at a constant thickness. As the relation between the concentration of the solution and its coefficient of the absorption of light only remains constant within certain limits, solutions of the necessary dilution have to be employed and unknown solutions must be diluted to this point: the value is then found by calculation.

Tables for calculations of various kinds required are given, and the memoir is illustrated with lithographs of the working details of the divided slit. A number of specimen curves are also given. The memoir is well worthy the attention of all who have to estimate the strength of colouring matter.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

Existence of Man in the Miocene

I have received a letter from Mr. Edmund Calvert, in which he informs me that his brother, Mr. Frank Calvert, has recently discovered, near the Dardanelles, what he regards as conclusive evidence of the existence of man during the Miocene period. Mr. Calvert had previously sent me some drawings of bones and shells from the strata in question, which Mr. Busk and Mr. Gwyn Jeffreys were good enough to examine for me. He has now met with a fragment of a bone, probably belonging either to the Dinotherium or a Mastodon, on the convex side of which is engraved a representation of a horned quadruped, "with arched neck, lozenge-shaped chest, long body, straight fore legs, and broad feet." There are also, he says, traces of seven or eight other figures, which, however, are nearly obliterated. He informs me that in the same stratum he has also found a flint flake, and several bones broken as if for the extraction of marrow.

This discovery would not only prove the existence of man in Miocene times, but of man who had already made some progress, at least, in art. Mr. Calvert assures me that he feels no doubt whatever as to the geological age of the stratum from which these specimens were obtained.

Of course I am not in a position myself to express any opinion on the subject; but I am sure that the statements of so competent an observer as Mr. Calvert will interest your readers.

High Elms, March 23 John Lubbock

Adaptation to External Conditions

The curious modification of adaptation to external conditions in the case of the *Salamandra atra*, which I have more than once brought under the notice of naturalists, but which I myself first noticed under the direction of Prof. von Siebold, has been cited by Mr. Darwin ("Origin of Species," 4th Ed. p. 534) in confirmation of his views. I revert to it now for the sake of its illustration of a new and striking observation, which has excited the incredulity of several eminent naturalists in France—an incredulity, we may suppose, founded on their ignorance of the previous observation. The fact to which I called attention was this: The ordinary salamander, or Newt, is born in the water as a tadpole, and in the water it completes its metamorphosis. But the *Salamandra atra*, living high up in the mountains, with no pools in which to pass its tadpole existence, is born on the land, a completely formed animal; that is to say it passes through the tadpole stage while still within its mother's body. I have taken it from the gravid female in this tadpole state, and placed it in water, wherein it swam as if that were its natal element.

In the *Revue Scientifique*, No. 37, there has just appeared a brief account of some observations made by M. Bavay at Guadeloupe, from which it appears that the frogs, having in that volcanic island no marshes nor pools suitable for the early tadpoles, have adapted themselves to these conditions by passing through

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all the tadpole stages of metamorphosis while still in the egg. All these stages have been observed by M. Bavay; and whoever is familiar with the evolution of the ordinary tadpole before it quits the egg, will see that M. Bavay has observed only a modified form of the well-known process. The Guadeloupe frog is born as a frog, not as a tadpole; and this, paradoxical as it may seem to some naturalists who cannot dismiss traditional conceptions, is even less remarkable than the case of the *Salamandra atra*, because it is only an extension of the period of incubation, whereas with the salamander it is the substitution of viviparity for oviparity. How the presence of water leads to an acceleration of the birth, or the absence of water leads to its retardation, is an interesting point for investigation; whether retarded or accelerated, the finally-acquired structure is the same.

The Priory, March 22 GEORGE HENRY LEWES

Anticipations of Natural Philosophy

MAUPERTUIS

HAVING lately had occasion to examine the works of Maupertuis I, like Prof. Jevons, was struck by meeting with anticipatory glimpses of the modern theory of Natural Selection. The passage, given almost word for word by Lord Bolingbroke in the quotation made by Prof. Jevons, occurs somewhat incidentally in two parts of Maupertuis' writings; in the memoir alluded to ("Les Loix du Mouvement et du Repos, déduites d'un principe métaphysique"); and in the "Essay de Cosmologie," into which the memoir was expanded five years later (1751). In both these works Maupertuis is chiefly concerned with establishing his well-known metaphysico-mechanical principle of "The Least Action" ("La moindre Quantité d'Action"); and with deducing therefrom proof of the existence of God. But the doctrine of "The Survival of the Fittest" is more clearly discernible, and more than incidentally referred to, in his small physiological treatise, "Venus physique" (Œuvres, tome ii. ed. 1756). The whole of this work is not wanting in interest, but as bearing specially on the subject in question, I would mention the third, fifth, and last chapters of the second part Chapter III. is entitled "Production de nouvelles especes." In it the most pronounced passage is perhaps the following: "Mais la sage Nature, par le dégoût qu'elle a inspiré pour ces défauts, n'a pas voulu qu'ils se perpetuassent; chaque père, chaque mère fait de son mieux pour les éteindre; les beautés sont plus sûrement héréditaires; la taille, et la jambe, que nous admirons, sont l'ouvrage de plusieurs générations, où l'on s'est appliquè à les former." Chapter V., called an "Essay d'explication des phénomènes précédents," is an attempt to explain the physiological processes at work in the preservation of the best types, and in the production of new forms. On the efficacy of these processes the author says: "L'expérience pourroit, peut-être, éclaircir ce point; si l'on essayoit pendant longtemps de mutiler quelques animaux de génération en génération, peut-être verroit-on les parties rétranchées, diminuer peu à peu; peut-être verroit-on les à la fin s'anéantir." The last chapter contains a summary of the whole work, and a number of "Doutes et Questions," propounded by the author. In one of these he asks, "Cet instinct des animaux, qui leur fait rechercher ce qui leur convient, et fuir ce qui leur nuit, n'appartient-il point aux plus petites parties dont l'animal est formé?" In another question Maupertuis puts forward a bold hypothesis as to the influence which the decomposed material of the dead animal organism might exercise upon plants, and through them upon the structure and character of the living organism.

In his *Système de la Nature* also (Œuvres, tom. ii. ed. 1756), Maupertuis combats the special creation theory of the origin of species, and advocates a doctrine, which may be called Natural Selection, the selective principle being placed in the ultimate elements of both organic and inorganic substances, of which elements "la perception est une propriété essentielle," and which "doués d'intelligence s'arrangent et s'unissent pour remplir les vues du Créateur."

Such are a few of the glimpses to be met with in the French philosopher, of the modern doctrine of Darwin and Spencer. Similar ones may not improbably be found elsewhere, but such "resultless tendencies," as the course of events has proved them to be, can in no degree detract from the merit and originality of those who have made of Natural Selection a well-substantiated and homogeneous theory. W. H. BREWER

Grace's Road, Camberwell, March 10

EMPEDOCLES

ON reading Prof. W. Stanley Jevons' interesting letter in this week's NATURE, I referred to my note-book, and found the following quotation, under the title of "Natural Selection," which shows that the opinion of Maupertuis is at least as old as Empedocles.—"Cette dernière opinion sert á expliquer les idées d'Empédocle sur la production des animaux par des causes accidentelles. L'attraction et la répulsion des élémens donnèrent naissance dans les commencemens et par le seul effet du hasard, à des têtes sans cou, à des jambes sans corps, à des animaux moitié bœufs et moitié hommes, en un mot, à une foule de monstrés semblances. Parmi tous ces êtres, les uns étaient construits de manière qu'ils semblaient êtres doués de l'intelligence: ceux-là conservèrent la vie, et propagèrent leur espèce, mais ceux auxquels l'organe de la vie manquait, retombèrent dans le chaos, d'ou ils étaient sortis." ("Histoire de la Medécine," par Kurt Sprengel, vol. i. p. 249.) Sprengel gives the following references:—Aristotle, Physic. Lib. ii., c. 4, p. 465., c. 8, p. 470. Owing to my distance from a public library I have not hitherto had an opportunity of referring to Aristotle; but as Prof. Jevons is more favourably circumstanced, I hope he will consult the original, and if he finds anything which throws further light upon this interesting question, that he will report it to your readers.

Although, as Prof. Jevons remarks, the introduction of the notion of *chance* is erroneous, the speculation shows how thoroughly the Greek Atomists had banished from their explanations of phenomena all reference to first and final causes, anticipating in this respect the modern conception of science. I cannot deny myself the pleasure of quoting the weighty judgment of Bacon upon this point:—"And therefore the natural philosophies of Democritus and others," says Bacon, "who allow no God or mind in the frame of things, but attribute the structure of the universe to infinite essays and trials of nature, or what they call fate or fortune, and assigned the causes of particular things to the necessity of matter without any intermixture of final causes, seem, so far as we can judge from the remains of their philosophy, much more solid, and to have gone deeper into nature, with regard to physical causes, than the philosophy of Aristotle or Plato; and this only because they never meddled with final causes, which the others were perpetually inculcating." (Advancement of Learning, Book iii. chap. iv.)

Waterfoot, March 8 JAMES ROSS

ARISTOTLE

IT is interesting, as Mr. Jevons says, to observe such traces as are to be found in history of theories more or less anticipating the principle of natural selection. But if the instance he cites from Maupertuis fairly represents the last century in this matter, it is chiefly of interest as showing what a little way it is possible to travel on certain roads in twenty-two centuries: for Aristotle discusses the same theory in his "Physics" (ii. 8), and appears to attribute it to Empedocles. "It may be a question," he says, "whether physiological effects which seem to be due to final causes are not really accidental. An organism survived, we may suppose, if it happened to be as a whole constituted in a suitable manner; that is, in a manner in which it would have been constituted by design; organisms otherwise constituted perished and perish still, like the *βουγενῆ ἀνδρόπρωρα* of Empedocles." Now, except that his monsters are certainly not quite so monstrous, I do not see that the "Flattener of the Earth" gets beyond that. At any rate he lags behind Lucretius, who adopts the same theory of "discriminative destruction" (v. 837–877), but applies it, as Mr. Munro points out (on line 855), not merely to monsters but to "regularly organised creatures," either not so gifted as to protect themselves or not so valuable as to be protected by man.

This is, as far as it goes, a theory of natural selection. It is a theory of the survival of the fit, absolutely; but not being a theory of the preponderant survival of the fitter, and not taking adequate account of inheritance, it is not a theory of evolution. Indeed, though Lucretius recognised a constant change in the conditioning circumstances, and therefore in the organisms conditioned (828–836), it was to account for the stability of species that he called in natural selection and not to give a clue to the laws of their variation. That is the direction in which there must have been most room for progress; and traces of such progress may be to be found. Has Mr. Jevons tried Gassendi? C. J. MONRO

Hadley, Middlesex

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